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Recognising the voluminous agencies of extractive landscapes: a critical agenda

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Introduction

With the development of ‘weather worlds’, Ingold (2010) put forward the idea that the body builds knowledge as it traverses and interacts with the landscape as a material and temporal space of variegated earth and turbulent air. This phenomenological understanding of a voluminous landscape has some conceptual kinship with Barad’s definition of agential realism, where she outlines how ‘phenomena do not merely mark the epistemological inseparability of observer and observed, or the results of measurements; rather, phenomena are the ontological inseparability/entanglement of intra-acting “agencies”’ (2007, p. 139). Indeed, Barad’s concept of intra-action aligns closely with Ingold’s earlier concept of the ‘taskscape’ (1993; see also Butler and Löff in this book) as a performative interpretation of landscape. By decentring the human as the possessor of agency, Barad contends instead that agency is ‘simply enacted or performed or rearticulated continuously’ (Akong 2020, p. 462) rather than inherently owned. This chapter draws on Barad and Ingold to consider how an agential, performative understanding of landscape facilitates a reinterpretation of the relations between planning practices and the extractive landscape they aim to govern.

In discussing industry and its capacity to alter the land, Tsing suggests that ‘[d]isturbance opens the terrain for transformative encounters, making new landscape assemblages possible’ (2015, p. 160). Understanding landscape as a continually shifting assemblage of material and social elements that operate in relation to one another is a helpful entry point for engaging with the mine site and its planning process. While there are several origins and interpretations of assemblage thinking (see McFarlane and Anderson 2011), I approach it through a new materialist lens that views nonhuman elements, that is, things that are not human, as having agency or the ability to act upon other elements.

Assemblage and agency go hand-in-hand. Bennett, like Barad, clarifies that ‘agency always depends on the collaboration, cooperation, or interactive interference of many bodies and forces’ (2010, p. 21). For instance, Nowak and Roynesdal (2022) propose a ‘botanical politics’ to describe both the management of unruly plants and people within the urban ecological assemblage, and their human and nonhuman capacity to resist managerial control. Specifically, they centre plants ‘as powerful symbols and actors’ (p. 1185).

Within this chapter, I advocate extending this towards a wider politics that finds resistance and agency in a broader range of nonhumans than plants alone. In doing so, I look to Yusoff’s (2017) advancement of the geosocial, where she establishes that substrata are brought into and support particular arrangements of social power. Within this world view, materials such as rocks and soil, alongside more conventional nonhumans such as animals, have the ability to exert agency through acting upon others without the assumption that they do so with conscious intention. In doing so, they uphold or challenge particular social structures.

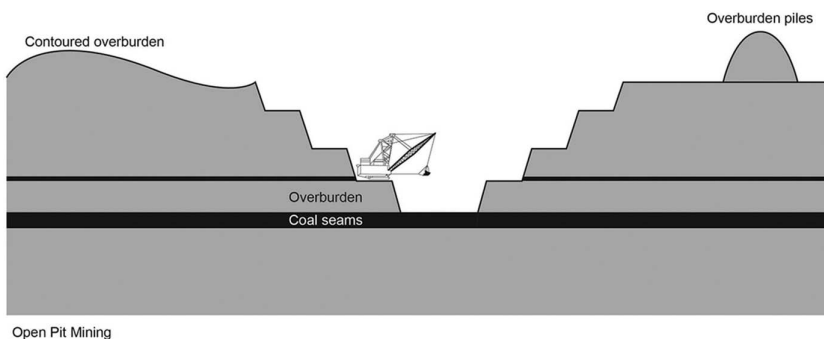
This assemblage perspective facilitates an ontological shift that situates landscape planning as beyond the exclusive control of people, recognising that in collaboration with planning practices, land itself—understood as shifting sociomaterial assemblages unconstrained by the borders or Euclidean space of planning—plays a central role in defining and orchestrating the possibilities for its future. The mining industry generates a range of severe impacts on landscapes, from leaving deep voids in perpetuity to depleting nearby aquifers. While this study focuses on the Australian context, these impacts are occurring globally, and there is a need for further landscape studies to scrutinise these effects. This chapter argues that to address the mining industry’s landscape impacts properly, we need to reframe our ontological understanding of what landscape is to more accurately capture the complexity and subtlety of its effects. This extended understanding of landscape simultaneously offers a much-needed avenue for critical analysis of how both the mining industry and regulatory systems approach and discuss landscape.

This chapter introduces two case studies with the aim of highlighting how landscape assemblages come together in different ways to challenge planning and operational practices in Australian coal mining. The first focuses on a mine going through closure and explores how the spontaneous combustion of coal becomes a geologic force that has significant power within the mine closure planning process. The second highlights the prevalence of dust in a township close to several operating mines. It considers the disconnect between dust management in mine planning and the voluminous landscape of a mining region where dust moves across boundaries and accumulates in inconvenient locations. Finally, the chapter establishes a future research agenda that advocates expanding planning representation of and relations with the landscape with the aim of recognising the influence of landscape assemblages within planning processes themselves. First, however, I provide an overview of how the concept of landscape is approached within mine planning approvals, with a particular focus on Queensland, Australia.

Mine planning

The extraction technique that a mining operation uses is central to the type and severity of impacts it has on the landscape both within and in proximity to its lease area. Open-cut mines, also known as open cast or open pit mines, are the most frequent extraction technique for Australian coal mining operations. Unlike underground mining, open-cut mines feature high levels of visible disturbance at the surface of the earth. They have a clear impact on the topography within the mining lease (Figure 9.1) in the form of the mining void or pit where extraction is undertaken, waste rock dumps where the extracted rock and soils above the ore are deposited, and—depending on the type of mineral being mined and its processing requirements—often also tailings dams. This specific type of mine has been increasing in popularity in Australia. Back in 2010, Gavin Mudd noted that ‘[o]ver time it can be seen that for most minerals there is a major shift to open-cut mining, as it commonly allows for more complete and economic extraction of contained minerals’ (Mudd 2010, p. 102). This trend, alongside the increasingly controversial nature of the coal industry, has led to open-cut coal mines becoming centres of sociomaterial conflict. The planning processes for new open-cut coal mines are replete with actors competing for the power to enact their preferred future. Each competing actor advocates for their own understanding of both the past and future of a mining landscape to become dominant. As such, planning becomes ‘a specific point within the life of mine where a range of different narratives *could* come to matter’ (Hine 2021, p. 2) depending on the capacity of actors to enrol others in their vision and consequently influence planning decisions.

The temporality and sheer physicality of mining activity and the industry’s capacity to entirely alter the condition of an area of land mean that within mine planning, the concept of landscape is deeply entwined with land use decisions. This is particularly evident in post-mine planning, where ‘reclamation is not solely a “landscape” or “engineering” issue [...] [i]t is a large-scale design issue that affects environmental



Source: Illustration by Amelia Hine.

Figure 9.1 Simple cross-section of an open-cut mining operation

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systems and the life supported by them' (Berger 2008, p. xviii). Putting aside the fundamental intent of the removal of ores for a moment, one might think of mining as a form of ephemeral landscape architecture, with the continuous creation of new landforms guided not by design sensibilities but instead by economics and safety requirements (Rosier 2022) as well as the limits of extractive technologies, optimal slope gradients, and regulatory restrictions. Despite the material nature of the extractives industry, the concept of landscape is both poorly conceptualised and ill-defined within Australian extractive planning practices, as I explore below.

Open-cut mines are multidecadal projects wherein the spatial characteristics of a site change on a daily basis. These changes must adhere closely to a mine plan, which is designed at the beginning of a project and goes through a planning approvals process to ensure that it is in accordance with legislation. Within my home state of Queensland, Australia, this process primarily involves state- and federal-level environmental assessments and securing a state-level mining lease agreement. Within this, mine operators must describe in varying levels of detail the pre-existing site where their mine will be located; the stages of the mine's operations; and offer a rudimentary plan for the final landform and characteristics of the site following closure (Queensland Government 2022b).

Within extractives planning approvals, the term 'landscape' includes its 'character' (Queensland Government 2022a, p. 3) and visual amenity values but more broadly encompasses the environmental and cultural values of a specific piece of land before, during, and after the process of mining. There is no specific definition of landscape within the planning process; however, one can be inferred through an examination of ongoing references to landscape within planning requirements. In Queensland, for example, would-be mining operations must predict the impact of their mine on 'the landscape and its associated visual amenity in and around the proposed project area' (Queensland Government 2022b, p. 12). To lay the groundwork for this, they must also assess 'the integrity of landscapes and places, including wilderness and similar natural places' (p. 20) prior to mining. They must demonstrate that their proposed final landform (following the mine's closure) is 'consistent with the surrounding natural topography and landscape' (p. 15). Finally, they must also study the pre-existing 'landscape heritage values' (p. 28) of the site.

This hodgepodge of phrases collectively conjures landscape as both the pre-existing topography and significant features such as vegetation or historical buildings within the mining lease prior to the start of extractive operations. The space within the mine lease is viewed in relation to the broader landscape in which it sits. This definition serves largely to rhetorically reduce landscape to a surface plane through the focus on topography and visual features, with a lack of reference to volume or depth.

I propose that formal planning requirements for the extractives industry would benefit from a more explicit engagement with the landscape as an assemblage with agential capacities. Embracing a broader understanding of what landscape is and what it can do would enable planning practices to bridge the discrepancy between assessments

and landscapes in practice. It is not that, at present, the landscape assemblage is restricted to a benign role through planning practices, but instead that planning fails to fully capture the ways in which the landscape assemblage defines and drives both operational and planning practices.

Landscape assemblages

To highlight the agential capacities of the mining landscape, I will focus on one particular fieldwork example of learning to locate and observe the political power of the material within the planning process. Between 2016 and 2018, I undertook 45 field interviews related to Leigh Creek coal mine in South Australia, focusing on the mine's closure and potential future landscape (Hine 2019, 2021; Hine and Mayes 2022). At the time of the interviews, the mine's closure had been announced, community consultation for the region's future had been undertaken, and both a mine closure plan and a report on possible futures for the region were in the process of being produced. I sought to understand the mechanisms through which new futures for the mine site itself might be imagined and enacted.

In the course of interviewing, I was introduced to spontaneous combustion of coal as an everyday knowledge held by locals, government, and industry. Spon-com, as it is called by these stakeholders, often occurs as a result of exposing coal to oxygen through human disturbances such as mining. A build-up of heat leads the coal to self-ignite, causing invisible sinkholes and hidden hotspots where temperatures above 600°C occur just below the surface of the earth (Finkelman and Stracher 2011). Without heat-sensing technology surveilling the mine site 24/7, it is virtually impossible to predict, hence the term 'spontaneous'. It is also often invisible to the naked eye, occurring beneath the surface of the earth. Spon-com, therefore, is not a single entity but a confluence of landscape factors that assemble together to create an effect.

So ubiquitous was spon-com that I absorbed an understanding of the way that it occupied the surface and subsurface of the mine site throughout my interviews, as well as simply through staying and interacting with people within the fieldwork area. Its sociopolitical influence on the decision-making processes for the mine's future landscape quickly became normalised within my own understanding of the mining landscape. It became clear that I could not ask extensive questions about potential post-mining landscape designs of people who did not believe there could be a post-mining landscape safe enough for people or animals to use. For example, an executive for an organisation that focuses on economic growth in remote South Australia stated, 'people have thrown around things like four-wheel drive training courses through there, potentially filling it up with water [...] but given that it is an old mine site, and that it is subject to spontaneous combustion, it's probably [...] not going to work'.

Here the lingering threat of spon-com events was discursively transformed into a health and safety risk that had the capacity to dictate future landscape possibilities. While the community and government were seriously concerned that the loss of the

region's major industry would result in its rapid economic decline—and therefore had a vested interest in post-mining landscape designs that enabled new industry, such as a rubbish dump, a theme park, or a training site—the risk associated with the site ultimately restricted which futures were understood as possible.

The assembled effect of spon-com, in collusion with risk management discourses, became a geologic force 'capable of interrupting, undermining or overwhelming the very conditions of doing politics or being social' (Clark and Yusoff 2017, p. 16). The mining company's closure plan focused on achieving a 'safe, stable, non-polluting and sustainable' landform, preparing it 'for transfer of control of the land back to the South Australian Government' (Flinders Power Partnership 2017, p. 44). This plan centred on the risk management of spon-com and primarily entails the rehabilitation strategy of reprofiling the waste rock dump slopes and covering them with inert material to reduce the ability of oxygen to enter and encounter carbonaceous materials (Flinders Power Partnership 2017). Correspondingly, the final report offering possible avenues for securing the region's economic future—the *Leigh Creek Futures* report (Lomax-Smith and Heneker 2016)—specifically ruled out all possible future landscapes for the site, except new mining activity, due to the health and safety risk of spon-com. Notably, the notion of creating a final landform that adheres to the hazy planning principles of a landscape that matches the surrounding topography and is responsive to environmental and heritage values is superseded by the need to ensure a nonvolatile landform.

The example of spon-com is evidence that what lies below is integral not only to how the surface of the site can be understood and reimagined, but also that the earth itself is politically active and powerful, if not intentionally so. Thinking with Barad's intra-action that views agency as the ability to act upon other entities rather than an internalised logic, spon-com can be viewed as a spatiotemporal possibility that exerts political power through the challenge or *risk* it poses to human health and safety. Risk management is one of the central guiding principles that undergird mine planning practices. By being perceived as a risk, the result of both material activities and human representation of those activities, spon-com thus was able to exert influence within the planning process and consequently have a direct impact on the final land use and landform that was approved by the South Australian government.

Mining impacts are regulated and permitted through planning and regulatory processes. At present, nonhuman landscape agencies are being subsumed into discursive regimes of planning such as risk management (Hine and Mayes 2022). The environmental regulatory system's failure to critically engage with and understand the role played by nonhuman agencies such as spon-com within planning processes prevents genuine engagement with them as material and sociopolitical phenomena. It allows decisions to be dictated by reactionary fear and easily manipulated by strategic industry rhetoric rather than thoughtfully planned in relation to material realities. Developing a more considered and deliberate ontological interpretation of landscape as a complex assemblage within mining industry regulatory and planning processes would allow a reengagement with the material of the mine site. Further, such

a reengagement has the potential to throw light on how landscape assemblages come together to exert power within regulatory systems and planning practices. A starting point for this deliberate engagement would be to revise the meaning of landscape within regulatory systems from its reductive assignment as topography, expanding and clarifying its definition and role, and consciously aligning operational and planning understandings of the mining landscape.

Voluminous materialities

Recognition of nonhuman agency in planning goes hand-in-hand with a thickened understanding of landscape as more-than-surface. Such a perspective unsettles planning because it draws attention to the limits of control, what Rose (2014, p. 217) labels 'externalities' over which humans have no power—an ungovernable other. Problems arise when planning attempts to treat space and its material assemblages as static through acts of laying down boundaries and delineating the limits of impact: 'a long-standing problem in mining codes [is that they ...] ignore the fundamental reality that mineral extraction occurs in voluminous space, where material and its effects seep from the underground through Earth's surface, and on into the water column and up into the air' (Conde et al. 2022, p. 329). As Steinberg and Peters note in relation to a particularly volatile form of voluminous space, 'any attempt to "know" the ocean by separating it into its constituent parts serves only to reveal its unknowability as an idealised stable and singular object' (2015, pp. 249–250). Specifically, they consider the ways in which its 'three-dimensional and turbulent materiality' (p. 247) can assist in 'the reimagining and relliving of a world ever on the move' (p. 248). Elemental geographies have furthered this thinking by applying the same principles of 'flows, flux, connection, change and uncertainty' (Peters and Steinberg 2019, p. 294) to less visibly turbulent three-dimensional contexts such as the earth and the atmosphere. Such an approach necessarily requires a rethinking of the relationship across these elemental volumes. Squire, in relation to events such as sandstorms and dust clouds, asks how we can 'account for the moments where the Earth's materiality is thrown into three dimensions and left hanging in the atmosphere?' (2021, p. 210).

This overlap between seemingly separate volumes and the merging of their constituent materialities forces a rethinking of the limits of territories and boundary-making that underlie planning processes and their effects. This reframing is particularly relevant in the context of open-cut mining in practice, where distinctions between spatial volumes such as atmosphere and earth are frequently blurred as a result of operational decisions, their intended or unintended consequences, and their relationship with the broader terrains in which extraction occurs.

I encountered one such example of this in the Central Queensland mining region known as the Bowen Basin. The Bowen Basin is home to more than 40 active coal mines (KPMG 2021). There are several townships within the Bowen Basin whose populations consist almost exclusively of coal mining employees, service workers, and their families. My colleagues and I visited one such town, Moranbah, while conducting

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fieldwork to understand how different stakeholders view the mining industry and their expectations in relation to it. A recurring, and yet once again largely invisible, localised problem was that of dust. Those we spoke to noted that no matter how frequently they washed their houses or cars, they would be covered in a layer of dust again in a matter of days. More generally, there are also well-documented health concerns in relation to airborne coal particulates that make the prevalence of dust within the town worth noting. Supporting localised concerns regarding dust are pollution reports and analysis that identify Moranbah as having some of the highest amounts of PM₁₀, or large airborne particulate matter, of any suburb in the country (Australian Conservation Foundation 2022).

The closest mines are approximately six kilometres from the township and are locally considered to be the source of much of the dust. Planning for open-cut coal mines includes detailed consideration of dust and mitigation techniques such as the use of large quantities of water for dust suppression and the strategic placement of sensors to monitor dust movement and concentration around the clock. This approach indicates that dust demands a particular type of planning, one that is both reactionary and anticipatory.

Approaches to mine planning attempt to model wind in order to understand dust's possible impacts, but despite complex calculations, wind movements can never be fully anticipated. Indeed, wind—and its capacity to work in tandem with dust/particulates to create an airborne and mobile blurring of air and earth (Zee 2021)—defies planning by demanding ongoing mitigation and monitoring techniques across the mining lifecycle (Figure 9.2). Wind as an externality also demands visibility of broader landscape assemblages: it originates elsewhere and encounters mine sites and loose particulates, regardless of the efforts of mining companies, on its way through. Its scales of movement and effect are much greater than that of the singular mine site, but wind can also scale up the social and environmental impact of a mine if it catches dust emissions from operations such as overburden dumping. As such, mining companies are forced to implement operational procedures that respond to 'adverse weather conditions' on the fly (BMA 2009a, p. 25). This can include placing restrictions on overburden dumping; the co-location of operations like dumping, coal excavation, and draglines in certain places; vehicle speed limits; and, stopping or reducing haul truck movements (BMA 2009a, p. 25). Within this regulatory context, wind has the power to impact and exert control over a mine's operational efficiency and potentially even its profit margins. It further has the capacity, through its disruptive unpredictability, to reassert the liveliness of earth and atmosphere, directly challenging their transformation through planning and operational regimes into territories of extraction.

Airborne dust's incompatibility with the rigidly Euclidean nature of planning boundaries forces mining companies and regulators to acknowledge that the physical limits of mines and mining impacts extend both far beyond their designated lease areas and into four dimensions. This is 'managed', or reduced in complexity, through the planning process by the development of a problematic binary, wherein those people or nonhumans considered vulnerable to dust are transformed into 'sensitive



Note: Above: a vehicle driving up the waste rock piles has a cloud of dust behind it. Below: a water vehicle is spraying the waste rock road to minimise dust.

Source: Photos by Amelia Hine.

Figure 9.2 Overburden piles surrounding a mine seen from the road into Moranbah

receptors’, and anything not considered sensitive remains unmodelled during planning and unmonitored during operations. How or what sensitivity is measured appears somewhat vague, but is some combination of the ability to complain about dust and/or being considered of sufficient value to be worth protecting from adverse health risks or amenity impacts (Queensland Government 2022b). Human dwelling centres fall across both categories, endangered species and agricultural animals in the former, and protected environmental areas in the latter. Two of the closest mines to Moranbah exclusively identify human residences as sensitive receptors (see BMA 2009b; Queensland Government 2021). In this sense, dust—or indeed the *potential* for dust—collaborates with risk and amenity discourses to make explicit and to further embed the deep subjectivities at play in extractive industry planning processes.

Interestingly, however, dust prompts a further reckoning with the embeddedness of mining within complex environmental systems. Sammler and House-Peters point out that ‘to engage volumetrics beyond just extending an empty Euclidean geometric space means contending with layers of soil, rock, water, animal, mineral, atmosphere, steel, glass, and waste that produce (and are productive of) these spaces’ (2023, p. 3). In the case of Moranbah, these material factors appear to be both affecting and being affected by the cumulative impact of the many mines operating in the region.

Mallet notes that soil water content in the top 7 cm of surface soil has an impact on the dust levels in Moranbah, with lower water content resulting in more dust, and that since 2011 ‘the soil water content has decreased by approximately 1% per year’ (2021, p. 30). Although he is careful to say that ‘[w]hether the presence of open-cut coal mines exacerbated the role of soil water content is unclear’ (p. 23), scientists from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) have modelled the cumulative impact of coal mines within mining regions on groundwater and surface water (Post et al. 2020). They recommend that coal resource developments that occur within 10 km of each other should be considering cumulative groundwater impacts, and those 40 km apart may still need to consider cumulative impacts on surface water. Considering the consumption of water by mining companies for dust mitigation alongside the continuous pumping of groundwater to prevent water from entering the pit and the significant amounts of water used in coal washeries—Post et al. note that the average mine in NSW and QLD ‘consume[s] around 225,000 ml of freshwater per year which is the equivalent of the water consumption of a city of 5.2 million people’ (2020, p. 2)—it seems possible that the loss of moisture from the soil that is increasing the severity of dust is directly related to the hyper-concentration of water-intensive mining practices in the region. Ironically, albeit speculatively, the increasing dustiness could be partially attributable to its own mitigation measures.

This integration of social and ecological processes that collectively ‘shape the land’ is reminiscent of the taskscape outlined by Ingold (1993), but also points to the limits of our control within landscape assemblages that encompass but are far more complex than our deliberate infrastructures. Not only do we as humans experience a limit to our capacity to govern materials such as dust and spontaneous combustion, but ultimately our governance is dependent on the behaviour of these material externalities: as Rose notes, ‘regardless of how experienced and skilful a ship captain may be, more often than not it is the winds, rocks and storms that determine the ship’s safe passage’ (2014, p. 217).

Reassembling landscape volumes: an agenda for future research

Both case studies speak to the ongoing friction between planning and operational realities within an extractive context. In particular, the concept of landscape remains poorly defined and misaligned between the two conditions. As the case studies highlight, the mining industry makes strategic use of the landscape as a complex and ambiguous concept to control both public perception and regulatory assessment through the planning process. This rhetorical misuse is facilitated through parallel representations of the landscape, where mine planning is aligned with Euclidean spatialities that reduce complexity through the flattening of space and the binarisation of sensitivity, while operational sites are positioned as voluminous, dynamic, and ungovernable. It is necessary to acknowledge that mining companies are themselves complex ‘macro actors’ (Golub 2014, p. 13). Golub defines the mine site as a leviathan, meaning the ‘power of bureaucracy incarnate: professional, dedicated, and disciplined people acting in accordance with predetermined rules and regulations’ (p. 14).

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As such, it is difficult to definitively determine whether these competing representations are borne of the desire for strategic advantage, allowing the company to operate as freely as possible, or simply an outcome of a limited ontological understanding of the mining landscape. There is a real need for further situated research that critically examines the positioning and use of landscape representations in extractives planning, and in particular their strategic enrolment in mining industry rhetoric.

Planning practices attempt to render the landscape into neat, self-contained elements and bounded land that can be made knowable and predictable. Specifically, extractive planning processes fail to engage with the landscape as an assemblage. Consequently, the planners—bounded by the legislative limits of mine planning and assessment—are unable (and perhaps unwilling) to recognise agencies that emerge from the land itself and its capacity to resist invisibility or exert political power over which futures are perceived as viable. Instead, mine planning manages points of ungovernability by placing limits on who or what matters and the edges of governance responsibility. To broaden what is possible, the legislation itself must be shifted to bring it in line with shifting ontological perspectives.

If regulators are willing to recognise landscape agencies—itself a research question that needs answering—then what I propose is needed is greater imagination and engagement with the landscape, across all points of the life of the mine and across a range of voluminous scales, from lawmakers themselves.

In charting a path forward, there are several areas that would benefit from further theoretical exploration and practical experimentation. Foremost is the quite serious need to address the ambiguity around landscape within extractive planning legislation and documentation, and to align it more carefully with the operational materiality of extraction. Further than just alignment, however, there is the potential to experiment with taking nonhuman agency seriously within the planning process. This would go further than critique and the work of highlighting gaps in recognition of nonhuman agency, but would aim to fill such gaps by working towards the ‘how’ of anticipating and responding to nonhuman material agencies and political power within planning.

Consideration of nonhuman materiality and its capacity for disruption is not restricted to mining landscapes, however. The increasing frequency and severity of natural disasters prompted by climate change are making voluminous materiality and its capacity to exceed the Euclidean space of borders and boundaries more visible. The global movement of smoke is one such example, with smoke from wildfires in Alberta moving across to settle over New York City in 2022 and also, memorably, the smoke from Australia’s 2020 bushfire season that traversed international waters to blanket Aotearoa New Zealand. The embeddedness of specific materialities and sites in much broader atmospheric and earth systems is of particular interest here. While there is an emergent body of literature on volumetric geographies and governance, there is scope to bring this into more explicit contact with theories on assemblage and more-than-human agencies.

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